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Math 4 Unit 2



Student Learning Guide

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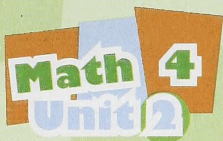
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Math 4 Learn EveryWare – Unit 2 Student Learning Guide
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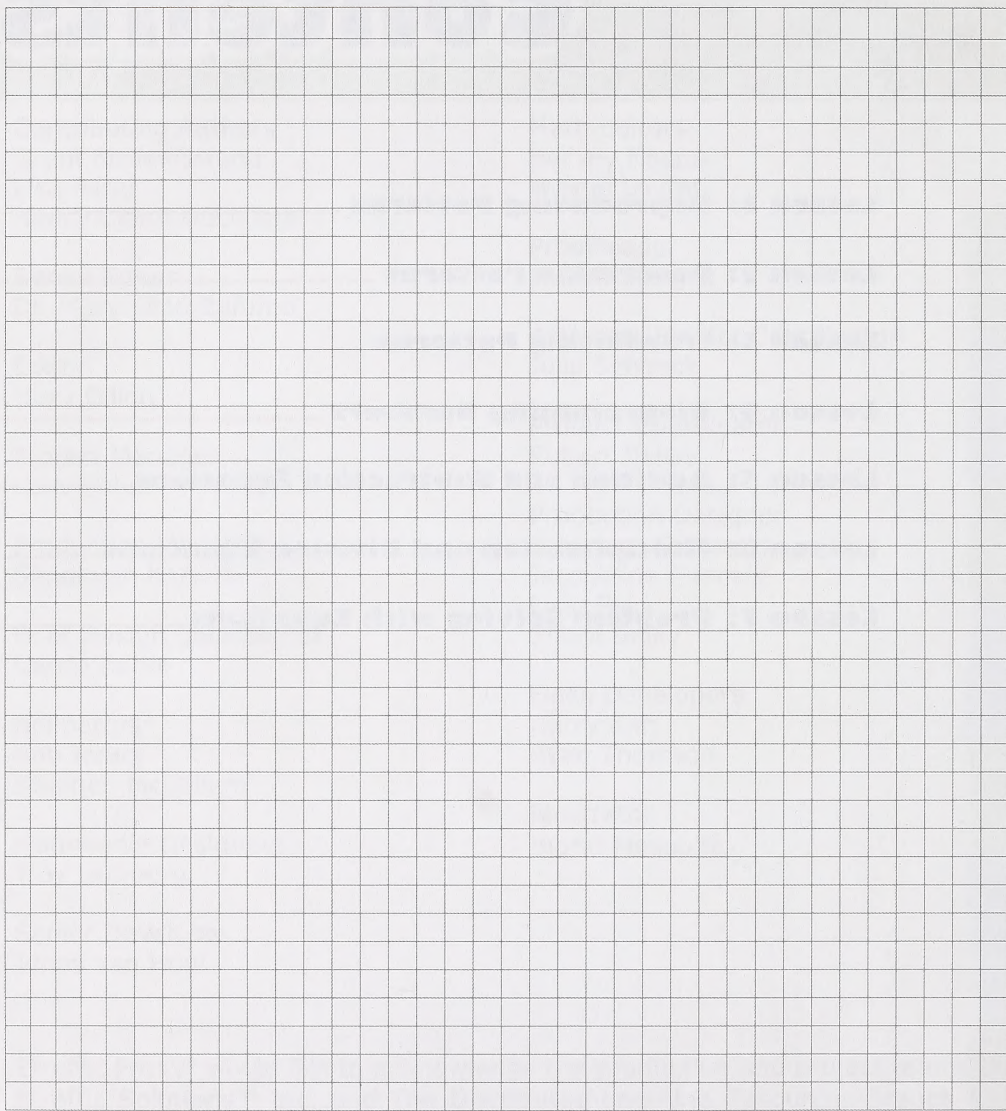
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Lesson

1

Reproducing Patterns

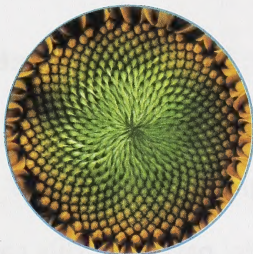
Patterns

A **pattern** is a series of numbers or objects that follow a rule. Patterns are everywhere.

There are patterns in the mosaic ceiling of the rotunda entrance to the Royal Ontario Museum. The tiles on the ceiling make a beautiful design.



Sample:



Patterns are in nature such as the way the seeds are arranged in a sunflower.

Sample:



Patterns are also in normal items you may have at home, such as wallpaper.

Reflection

What are some other patterns that you have seen in your home or in a building you have gone to?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Create a representation of a given pattern
- Explain the relationship between a picture and its numeric pattern

Go online to complete the Concept Capsule: Reproducing Patterns Using Pictorial Models.

Modelling Patterns

You can use pattern blocks and counters to model patterns. This can help you discover a **rule** for creating the pattern. There is a page of Pattern Blocks at the back of this Unit in your Workbook. Cut them out and use them to help you discover patterns. Save them when you have finished this Example. You will use them again.

Example 1

You can use patterns to decide what shapes come next in a design. Look at the design and find the repeated pattern.



What are the next three shapes in the pattern? Use pattern blocks to recreate the pattern:



When do you notice that you have to start over?



This is the rule: square, circle, triangle.

The next three shapes in the pattern are:   

Lets explore! There is a page of Counters at the back of this Unit in your Workbook. Cut them out and use them to help you model patterns. Save them when you are finished. You will use them again.

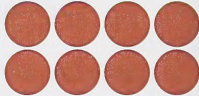
Example 2

Rachel wants to run in a race. She made a training schedule that will help her to start slow. Rachel records her training in a chart.

Day	Kilometres Run
Monday	2
Tuesday	4
Wednesday	6
Thursday	8
Friday	

- a. Create a model of the chart information.

Let one counter represent 1 kilometre.

Monday	Tuesday	Wednesday	Thursday
			

- b. Explain why the pattern in your model is the same as the pattern in the chart.

You can see that each day increases by 2 counters. Rachel is running 2 more kilometres each day. This matches the chart because:

$$2 + 2 = 4, 4 + 2 = 6 \text{ and } 6 + 2 = 8$$

- c. Decide if Rachel will be able to run a 15 kilometre race on Saturday.

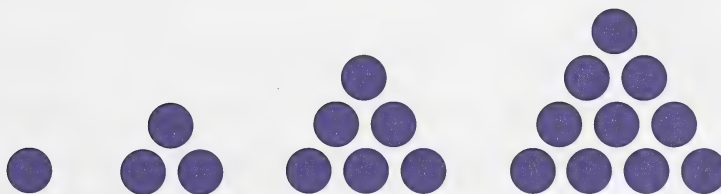
On Thursday she ran 8, and $8 + 2 = 10$ for Friday.

On Saturday she will run $10 + 2 = 12$.

No, she will not be able to run a 15 kilometre race on Saturday.

Modelling Triangular Numbers

A famous group of numbers are the triangular numbers. They are formed using counters to create triangles:



Triangle Number	Number of Counters
1	1
2	3
3	6
4	10

Example 3

How many counters will it take to create triangle number 10 of the triangular numbers?

Strategy 1: Using counters, create triangles 5 – 10 one at a time. Add counters to triangle 1 to get triangle 2 and so on.

Here is triangle 10:



Strategy 2: Continue the pattern in the table:

Triangle Number	Number of Counters
1	1
2	3
3	6
4	10
5	15
6	21
7	28
8	36
9	45
10	55

+

+2

+3

+4

+5

+6

+7

+8

+9

+10

The 10th triangle of the triangular numbers has 55 counters.

**Let's Explore****Exploration 1: Square Patterns**

Materials: Unit 2, Lesson 1, Exploration 1 page from your Workbook, Grid Paper from the back of this Unit in your Workbook, Pencil

1. Shade a 1×1 (1 by 1) square on your grid paper.
2. Shade a 2×2 square on your grid paper.
3. Shade a 3×3 square on your grid paper.
4. Continue creating as many squares as you need to find the pattern.
5. Complete the table for the side length and the total number of squares.
6. What is the pattern you see in the total number of squares?
7. Suppose you have a square with a side length of 10 on each side. Can you predict the total number of squares?
8. Reflect: How does the total number of squares relate to the length of each side?

Example 4

Use counters to represent the pattern in Column B. Describe the rule.

A	B
1	2
2	4
3	6
4	8
5	10

1: Use counters to represent the values in Column B:



2: Make observations as you add counters each time. How many did you add? In this case you added two counters each time.

The rule is: add 2 each time

The counters represent the numbers in Column B. By using counters or other models you may notice the pattern more quickly.



- In your Workbook go to Unit 2, Lesson 1 and complete 1 to 8.



Lesson 2

Describing Patterns

Patterns in Nature

Sweet pea plants grow really fast. These beautiful flowers can be trained to grow up a trellis. They can grow as much as one metre in one month.

Daksha has sweet peas growing outside his bedroom window. He decided to measure the growth of his plants each day. On the first day the plant was 58 cm tall. He found that the growth of the plant could be described as "add 2 cm each day". That information can be displayed in a table:



Day Number	1	2	3	4	5	6	7
Plant Height in CM	58	60	62	64	66	68	70

You can use words to describe a pattern. You will learn how to describe patterns in two ways in this lesson.

Reflection

Suppose Daksha measured the height of the sweet peas on random days instead of every day. Would he be able to find the pattern to the height of the sweet pea plants? Why or why not?

Objectives for this Lesson:

In this lesson you will explore the following concepts:

- Describe the pattern found in a given table or chart
- Extend patterns found in a table or chart to solve a given problem
- Identify and describe a variety of patterns in a multiplication chart
- Identify errors in a given table or chart
- Determine the missing element in a given table or chart

Describing Patterns

Patterns can help you solve problems. It is helpful to be able to identify patterns. A quick way to solve problems is to identify a rule. The pattern in a set of numbers will lead you to the rule.

You can describe a simple operation pattern with the words:

add

subtract

multiply

divide

You can use these words to describe patterns in charts and tables.
Charts and tables relate two or more values.

A	B
1	5
2	10
3	15
4	20
5	25

In this table there are two questions you want to explore:

Question 1: What is the pattern in Column B?

You should look for a simple operation pattern.

You look down the column for the pattern.

A	B
1	5
2	10
3	15
4	20
5	25



Question 2: How does A relate to B?

You are looking for an operation that you can perform on A to get B.

You look across the rows for the pattern.

A	B
1	5
2	10
3	15
4	20
5	25

Sometimes the pattern of the second column is much easier to identify than the relationship between A and B.

You should look for patterns that have increasing numbers or decreasing numbers. These limit the choices you have for describing patterns:

Increasing	Decreasing
Add	Subtract
Multiply	Divide

First you need to know if the pattern increases or decreases. Next, test the two operations until you find the right one.

Reflection

How does identifying patterns relate to skip counting?

Example 1

Describe the pattern of Column B in the table:

A	B
1	12
2	18
3	24
4	30
5	36
6	42
7	48

1. Is the pattern increasing or decreasing in Column B?

The pattern starts with 12 and goes to 48. It is increasing.

2. Can you add a number to generate the second number in the pattern?
If yes, what number?

You can add 6: $12 + 6 = 18$

3. Can you repeat this addition to generate the rest of the pattern?

$$18 + 6 = 24, 24 + 6 = 30, 30 + 6 = 36 \dots \text{Yes.}$$

4. Describe the pattern in Column B:

The answer is: Add 6

Example 2

Describe the pattern of Column B in the table:

A	B
1	3
2	9
3	27
4	81
5	243

1. Is the pattern increasing or decreasing in Column B?

The pattern starts with 3 and goes to 243. This is increasing.

2. Can you add a number to generate the second number in the pattern?
If yes, what number?

Yes. 6.

3. Can you add 6 to the next number and so on?

$$9 + 6 = 15 \quad \text{No}$$

4. Adding didn't work, so try multiplication:

Can you multiply by a number to generate the second number in the pattern?

$3 \times 3 = 9$ Yes

5. Can you repeat this multiplication to get the rest of the pattern?

$9 \times 3 = 27$, $27 \times 3 = 81$, $81 \times 3 = 243$ Yes

6. Describe the pattern in Column B:

The answer is: Multiply by 3

Go online to watch the Notepad Tutor: Describing Number Patterns.

Extending Patterns

Another way to solve problems is to extend a pattern. This means to find more elements of the pattern. You must first identify the pattern. Use the exploration here to work with extending patterns.



Exploration 1: Table Planning



Materials: Unit 2, Lesson 2, Exploration 1 page from your Workbook, Square counters, Dry peas or other small objects, Pencil

Mrs. Smith is planning a birthday party. She has square tables that she lines up in a row. In this figure, squares represent the tables and purple circles represent the chairs.



1. Use square counters and peas to model this situation.
2. Fill in the table for the pattern. Relate the number of tables to the number of people that can be seated.

Number of Tables	Number of People
1	4
2	6
3	8
4	
5	
6	
7	

3. What pattern do you notice in the Number of People column?
Describe the pattern to your group or a partner.

4. How many people can sit at a grouping of 4 tables?
5 tables? 6 tables? 7 tables?
5. How many tables will Mrs. Smith need to seat 18 people?
6. Can you think of a rule that relates the number of tables to the number of people?

Example 3

Extend the pattern in the table given.

A	B
1	23
2	26
3	29
4	32
5	
6	
7	

1. Identify the pattern in Column B:

Add 3 to each number.

2. Use the pattern to get each following number.

A	B
1	23
2	26
3	29
4	32
5	35
6	38
7	41

← +3

← +3

← +3



- In your Workbook go to Unit 2, Lesson 2 and complete 1 to 10.

Patterns in Multiplication

A hundreds chart may be used to observe multiplication patterns. In a hundreds chart you can find patterns by shading the fact family for a number. The family of 3s has been shaded in this sample. You can use this visual pattern to help you learn your multiplication facts.

This is a sample where the following are shaded:

$$1 \times 3 = 3$$

$$2 \times 3 = 6$$

$$3 \times 3 = 9$$

$$3 \times 4 = 12$$

$$3 \times 5 = 15$$

...and so on.

Notice the visual pattern of **diagonals**.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Notice that there is a pattern when you look across the rows.

You can find other multiplication patterns using a Hundreds Chart. In this experiment you will use a hundreds chart and a multiplication table.



Exploration 2: Multiplication Patterns

Materials: Unit 2, Lesson 2, Exploration 2 page from your Workbook, Crayons, Counters, Hundreds Charts and Multiplication Tables from the back of this Unit in your Workbook

1. Use crayons and a Hundreds Chart to highlight numbers found by skip-counting two or more of the following:

by twos
by fives
by eights

by threes
by sixes
by nines

by fours
by sevens
by tens

If you are working in pairs or groups, each group should choose different patterns.

2. Can you find the pattern that begins: 3, 6, 9, 12... on the multiplication table? What three numbers will come next when you extend this pattern?
3. Tell a friend about one pattern that you found on the Hundreds Chart. How would you describe that pattern to a friend?
4. Tell a friend about one pattern that you found in the multiplication table. How would you describe that pattern to a friend?
5. Suppose that you wanted to find a pattern of even numbers. Where would you look?

6. Skip-counting by what numbers will include 100 as part of the pattern?
7. Count by 2s beginning with 1 in the Hundreds Chart. What pattern do you notice? Why?
8. What pattern do you notice when skip-counting by 10s starting with 3? Why?
9. A square number is made by multiplying a number by itself.

$$1 \times 1 = 1, \quad 2 \times 2 = 4, \quad 3 \times 3 = 9 \dots$$

1, 4, 9, 16... are all square numbers.

Colour all of the square numbers in the multiplication table.

Describe the pattern.

Identify Errors in a Table or Chart

Sometimes people make mistakes. Many charts have values that fit a rule. If all the values except one fit a rule, then there is a mistake.

Example 4

Identify the incorrect number in the table. What number should be in its place?

Day	Kilometres Run
Monday	3
Tuesday	6
Wednesday	7
Thursday	12
Friday	15

1. Look at the second column. What do you notice about the pattern?

The pattern looks like counting by 3s:

3, 6, 9, 12, 15 ...

2. What number messes up that pattern?

The 7 on Wednesday does not fit this pattern.

3. What number needs be in its place?

7 needs be replaced with a 9.

The answer is: Wednesday needs to say 9 kilometres run.

Determine Missing Numbers in Patterns

If a number is missing in a table or chart you can find it using the pattern. Describe the pattern for the column that contains the missing number. Use the pattern to find the missing number.

Example 5

Find the missing number in the table:

A	B
1	23
2	20
3	17
4	
5	11
6	8
7	5

The numbers are decreasing in Column B. Try subtraction or division to identify the pattern.

Can you subtract or divide a number to get from one number to the next in the pattern?

$$23 - 3 = 20, \quad 20 - 3 = 17, \quad 11 - 3 = 8, \quad 8 - 3 = 5, \text{ so yes.}$$

Describe the pattern: subtract 3

Subtract: $17 - 3 = 14$.

The missing number is B = 14 for A = 4

A	B
1	23
2	20
3	17
4	14
5	11
6	8
7	5



- In your Workbook go to Unit 2, Lesson 2 and complete 11 to 33.



Lesson 3

Translating Patterns

Poultry Farming



Poultry farming once consisted of the farmer's wife throwing out feed to the chickens. The chickens would wander about the farm yard. She would collect the eggs before they could rot.

Poultry farming has changed drastically and is now a large industry. Farmers have large buildings called "laying houses" that hold thousands of birds. Scientists and veterinarians help the farmers to make sure that they have the correct feed for the chickens. It is important to make sure that the chickens are healthy. Farmers now want to produce the most eggs possible so they can sell them.

Farmers may start with a small number of chickens. They can then increase the number of chickens each year. Look at the following chart showing one farm's egg production for 5 years.

Year	Number of Chickens	Eggs Produced
1	100	30 000
2	200	60 000
3	300	90 000
4	400	120 000
5	500	150 000

Reflection

What is the pattern in the number of eggs produced? What other types of information can you put in chart form?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Use information in a chart or table to solve a problem
- Extend the pattern in a table to solve a problem

Cricket Chirps

A cricket makes a unique sound called a chirp. It makes this sound by rubbing its legs together. The number of chirps a cricket makes is related to the temperature. The hotter it gets, the more it chirps.

Number of Chirps each Minute	Temperature in Degrees Celsius
144	24
148	25
152	26
156	27
160	28

So how does this relate to the solving pattern problems?

A table or chart helps you organize information so you can solve a problem. You can see the patterns when work is organized.

Using Information in a Table to Solve a Problem

Look for information in a table to help you solve a problem.
What is the pattern?

Number of Flowers	Number of Petals
2	12
4	24
6	36
8	48

Lian is planting flowers. Each flower has the same number of petals. The next day Lian finds that 7 flowers are missing their petals.



Example 1

How many of Lian's petals are missing?

1. Find the pattern

	Number of Flowers	Number of Petals	
2	2	12	} 12 } 12 } 12
2	4	24	
2	6	36	
2	8	48	

2. Where would 7 flowers be located in the table?

If you are thinking "between 6 and 8" then you are right. You could even write it in the table so that you can see it...

	Number of Flowers	Number of Petals	
2	2	12	} 12 } 12 } 12
2	4	24	
2	6	36	
2	8	48	



3. Now, what number goes between 36 and 48 in the Number of Petals column? There are two strategies you could use here:

Strategy One	Strategy Two
1. Find the number of petals for 1 flower: Since 2 flowers have 12 petals, Divide: $12 \div 2 = 6$ petals on each flower 2. 7 belongs after 6. Start with 6 flowers, 36 petals and add the 6 petals to the 36: $36 + 6 = 42$ petals	1. Find the number of petals for 1 flower: Since 2 flowers have 12 petals, Divide: $12 \div 2 = 6$ petals on each flower 2. If there are 6 petals on each of the 7 flowers, how many petals are there? Multiply: $6 \times 7 = 42$ petals

You may even find your own strategy.
There are 42 petals missing.

Extending the Pattern

Daksha and Zach are making a **square pyramid** of baseballs before the big tournament. They want to have 5 layers of baseballs. The pattern is in the table shown.

Layer Number	Number of Balls
1	1
2	4
3	9
4	16
5	



Example 2

How many baseballs do they need to complete their pyramid?

1. First you need to find the number of baseballs in layer 5. Figure out the pattern by looking at the number of balls column.

Layer Number	Number of Balls	
1	1	
2	4	$1 + 3$
3	9	$4 + 5$
4	16	$9 + 7$
5	25	$16 + 9$

You should notice that the pattern can be found by adding odd numbers. The odd numbers added have a pattern too:

3, 5, 7, 9

These are **consecutive** odd numbers.

2. Now you need to add the number of baseballs in each layer to get the total number of baseballs:

$$1 + 4 + 9 + 16 + 25 = 55$$

Daksha and Zach need 55 baseballs to make their pyramid.

Finding a Rule

A rule **relates** the first set of numbers to the second set of numbers. You can find rules by looking for an **operation** across the row.

	
1	12
2	13
3	14
4	15
5	16

This table shows the **relationship** between  and :

	Rule	
1	$1 + 11 = 12$	12
2	$2 + 11 = 13$	13
3	$3 + 11 = 14$	14
4	$4 + 11 = 15$	15
5	$5 + 11 = 16$	16

The rule is  + 11 = .

Patterns are generated by the rule. This means that each value in the second column of the table may be found using the rule.

A pattern of **add a number greater than one** each time down a column...

A	B		A	Rule	B
3	6	} +2 +2 +2 +2	3	$3 \times 2 =$	6
4	8		4	$4 \times 2 =$	8
5	10		5	$5 \times 2 =$	10
6	12		6	$6 \times 2 =$	12
7	14		7	$7 \times 2 =$	14

Becomes...

...translates to multiplication across a row. Add 2 becomes multiply by 2. Add 3 will become multiply by 3. Notice that the Column A elements are in order with no skipping. This must be true when looking for the rule using this method.

If the pattern is **add 1** each time down the column...

A	B		A	Rule	B
8	4	} +1 +1 +1 +1	8	$8 - 4 =$	4
9	5		9	$9 - 4 =$	5
10	6		10	$10 - 4 =$	6
11	7		11	$11 - 4 =$	7
12	8		12	$12 - 4 =$	8

Becomes...

...try adding or subtracting across the row. Adding one in the pattern means there will be no multiplication. To find the rule you can guess-and-test until you find the number you will add or subtract across rows.

Here is an experiment that will allow you to explore a pattern by creating a table.



Let's Explore

Exploration 1: Toothpick Triangles

Materials: Unit 2, Lesson 3, Exploration 1 page from your Workbook, Toothpicks, Pencil



1. Form a triangle with 1 toothpick on each side. Count the number of toothpicks in the triangle.
2. Form a triangle with 2 toothpicks on each side. Count the number of toothpicks in the triangle.
3. Continue forming triangles using this pattern until each side has 5 toothpicks.
4. What pattern do you notice in the number of toothpicks? Why do you think this pattern happens?
5. How many toothpicks would be in a triangle with 7 toothpicks on each side? How many toothpicks would be in a triangle with 20 toothpicks on each side? What is the rule?
6. If you repeated this experiment creating a square each time, how would the pattern change? What is the rule for finding the number of toothpicks in a square?



Extending a Pattern to Solve a Problem

Organizing your information in a table should help you solve problems. Tables help you see the patterns in the numbers.

Alyssa's family is going to rent a boat for the day. The family has been given a chart listing the costs of boat rentals.

Hours of Boat Rental	Cost in Dollars
3	45
4	55
5	65
6	75
7	85

Example 3

If Alyssa's family rents a boat for 10 hours, how much will they pay?

Notice the pattern in the costs for each hour: 45, 55, 65, 75, 85, __

The pattern could be described as **add 10**.



	Hours of Boat Rental	Cost in Dollars
	3	45
	4	55
	5	65
	6	75
	7	85
+1	8	95
+1	9	105
+1	10	115

It will cost Alyssa's family \$115 to rent a boat for 10 hours.



Let's Explore

Exploration 2: Special Patterns in Nature

Materials: Unit 2, Lesson 3, Exploration 2 page from your Workbook

Many of the natural patterns are the most beautiful to see. The following pictures are examples of these types of patterns:



The pattern of the scales of the pinecone and the fruitlets of the pineapple are in a special pattern. This pattern is part of the Fibonacci Numbers. It is a famous pattern discovered by a man named Fibonacci. Let's look at the Fibonacci pattern:

The two starting numbers are 0 and 1.

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 ...

Do you see the pattern?

Hint: The third number in the pattern is the sum of the two starting numbers:

0, 1, so the third number is $0 + 1 = 1$

The fourth number is the sum of the second and third number:

0, 1, 1, so the fourth number is $1 + 1 = 2$

1. Can you figure out what number comes after 55?
2. Extend the Fibonacci pattern to the 15th number.
3. Reflect: Have you seen any Fibonacci numbers in your yard or neighbourhood?



- In your Workbook go to Unit 2, Lesson 3 and complete 1 to 15.

Go online to complete the Concept Capsule: Determining Pattern Rules.

Lesson 4

Diagramming Numbers

Home Gardening

Growing flowers or vegetables can be an interesting and fun hobby. Your garden might be small and just have a few plants. It might be as big as your whole back yard. To be successful at gardening you must watch the plants closely. You need to make sure that they are growing properly.



It is important to know how much water plants receive. A rain gauge is an instrument that measures how much rain or water falls in a specific area. Gardeners can put one of these gauges in their garden. It helps them to make sure that the garden is getting enough water. It is helpful to keep a log or journal of the rain amounts.

The following chart shows the amount of rainfall for the month of May. Each number represents the day of the month. For example, the number 5 is in the section named "Less than 0.5 cm." This means that on May 5th, there was less than 0.5 cm of rain.

Less than 0.5 cm	More than 0.5 cm
1, 2, 3, 5, 8, 9, 10, 11, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	4, 6, 7, 12, 13, 14, 21

Are there more days with less than 0.5 cm of rain or more than 0.5 cm of rain? There are more days with less than 0.5 cm of rain. This information is helpful for gardeners. They will know when there isn't a lot of rain. On those days, they may need to water the garden themselves.

Reflection

What other information could a gardener track in a chart? How would this be helpful for them?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Complete a Carroll diagram
- Solve a given problem using a Carroll diagram
- Determine where new elements belong in a given Carroll diagram

- Identify a sorting rule for a given Venn diagram
- Determine where new elements belong in a given Venn diagram
- Describe the relationship shown in a given Venn diagram
- Solve a given problem using a chart or diagram

Go online to watch the Notepad Tutor: Number Pictures.

Carroll Diagrams

A **Carroll diagram** is used to group items. You can use these diagrams to place numbers or objects in a category.

These diagrams are named in honour of Lewis Carroll. He was the author of *Alice in Wonderland*. He was also a mathematician and created diagrams to solve problems.



A Carroll diagram is used to put sets of numbers in the groups. They belong to these groups based on the answer to a yes or no question.

Sets of numbers will look like this:

$\{2, 4, 5, 6, 7, 9, 12, 14\}$

Each set has **elements**. 2 is an element of this set. This set has eight elements.

A set of numbers may be organized using Carroll diagrams. You need a set and a yes or no question.

Example 1

Which of the numbers in the set $\{2, 4, 5, 6, 7, 9, 12, 14\}$ are even?

Here is a Carroll Diagram for the numbers in the set: $\{2, 4, 5, 6, 7, 9, 12, 14\}$

Even	Not Even
2, 4, 6, 12, 14	5, 7, 9

This diagram answers the question: Which numbers are even? The numbers are either even or **not** even.

Use the same number set to ask the question: Which numbers are greater than 6?

> 6	Not > 6
7, 9, 12, 14	2, 4, 5, 6

You can see that the Carroll diagram helps you to answer questions quickly and in an organized manner.

Example 2

Given the set $\{1, 2, 3, 4, 5, 6, 7\}$, which numbers are even?

Create a Carroll diagram with the two options: Even and Not Even.

Even	Not Even

For each number, ask yourself: Is it even?

If yes put the number under Even. If not, put the number under Not Even.

Even	Not Even
2, 4, 6	1, 3, 5, 7

A number is **divisible** by another number if it divides into it evenly.

$$12 \div 2 = 6 \text{ so } 12 \text{ is divisible by } 2.$$

Using a calculator:

$$13 \div 2 = 6.5$$

This means that 13 is NOT divisible by 2. If a number is divisible by 2, it is even.

Adding Elements to the Diagram

More numbers may be added to the set already in the diagram. You should continue the same as before. Ask yourself if each new element fits the **attribute**.

Example 3

Add these elements to example 1: {10, 11}

Ask yourself if each is divisible by 2 to determine if it is an even number.

Since 10 divided by 2 is 5, 10 is an even number.

Even	Not Even
2, 4, 6, 10	1, 3, 5, 7

Since 11 is not evenly divisible by 2, 11 is not even.

Even	Not Even
2, 4, 6, 10	1, 3, 5, 7, 11

Carroll Diagrams for Two Attributes

You can also use Carroll diagrams to check for more than one attribute. The Carroll diagram will need a column in front for one attribute and the first row for the other attribute.

	First Attribute: Less than 50	
Second Attribute: Odd	Less Than 50	NOT Less Than 50
Odd		
NOT Odd		

A **prime** number is a number that is ONLY divisible by 1 and itself. Here is a Hundreds Chart with the prime numbers from 1 to 100 shaded.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Use this table when you are asked to diagram prime numbers.

Example 4

Make a Carroll diagram with the numbers 1 through 39.

Attribute 1: Prime

Attribute 2: Even

This is much easier to do using Number Squares. You can use the Number Squares at the back of this Unit in your Workbook to help you. When you are finished using them, put them in a safe place. You will use them again.

1. Sort the number squares into Even or Not Even

Even	Not Even
2 4 6 8 10	1 3 5 7 9
12 14 16 18 20	11 13 15 17 19
22 24 26 28 30	21 23 25 27 29
32 34 36 38	31 33 35 37 39

Remember to use your Hundreds Chart of prime numbers to answer prime or not prime.

2. Now that you have sorted them into not even and even you can sort them as prime or not prime within these two groups.

	Even	Not Even
Prime	2	3 5 7 11 13 17 19 23 29 31 37
Not Prime	4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38	1 9 15 21 25 27 33 35 39

3. Create a Carroll Diagram for the four categories: Prime, Not Prime, Even, Not Even:

	Prime	Not Prime
Even		
Not Even		

4. Use your number squares to fill in the appropriate spaces.
The answer is:

	Prime	Not Prime
Even	2	4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38
Not Even	3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37	1, 9, 15, 21, 25, 27, 33, 35, 39

Now It's Your Turn

Make a Carroll diagram for each situation.

- The number set {1, 2, 3, 4, 5, 6, 7, 8, 9} and the attributes: Prime and Odd
- The number set {2, 5, 17, 30, 40, 41, 42, 43, 50, 55} and the attributes: Even and Divisible by 5

Solutions:

a.

	Prime	Not Prime
Odd	3, 5, 7	1, 9
Not Odd	2	4, 6, 8

b.

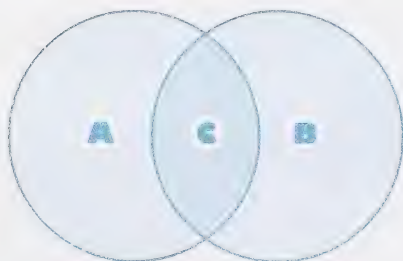
	Divisible by 5	Not Divisible by 5
Even	30, 40, 50	2, 42
Not Even	5, 55	17, 41, 43



- In your Workbook go to Unit 2, Lesson 4 and complete 1 to 5.

Venn Diagrams

A **Venn diagram** is made up of two or more overlapping circles. These diagrams are named for John Venn who invented them in 1881. It is often used in mathematics to sort information into groups. Look at the diagram. There are three regions – A, B and C.

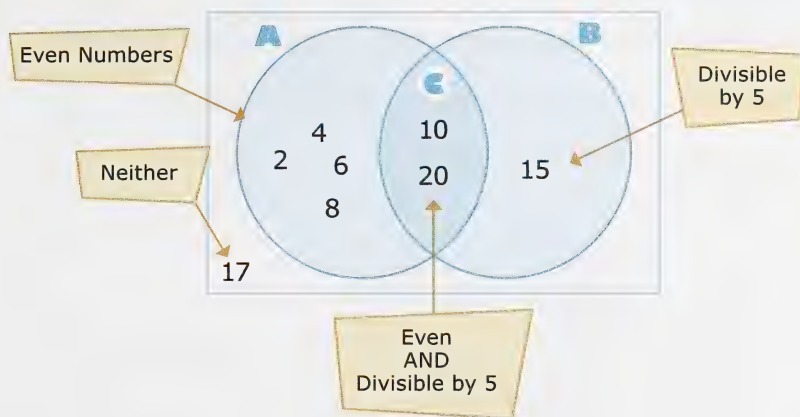


Region **A** belongs to group A.

Region **B** belongs to group B.

Region **C** belongs to group A and B.

This Venn diagram uses the rules Even Numbers and Numbers Divisible by 5 to organize the number set $\{2, 4, 6, 8, 10, 15, 17, 20\}$:



Region C is called the **intersection** of A and B. Each number in the set is an **element**. The rectangle is a boundary for all elements in the set. It should contain all the elements. If a number does not fit either rule, it goes outside the circle but inside the rectangle.

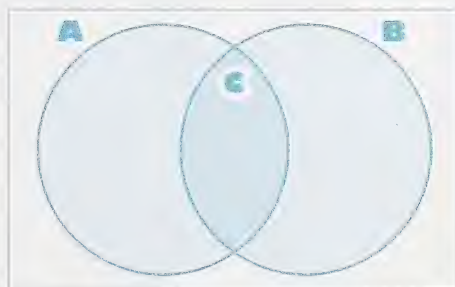
Example 5

Organize the set $\{1, 3, 5, 6, 7, 9, 11, 12\}$ using these rules:

A = divisible by 3

B = odd numbers

1. Draw a Venn diagram:
2. Underline the odd numbers:
1, 3, 5, 6, 7, 9, 11, 12



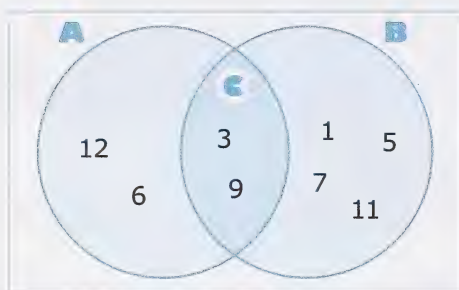
3. Circle the numbers divisible by 3:

1, 3, 5, 6, 7, 9, 11, 12

4. Place numbers with a circle AND an underline in region C.

Place the rest of the circled numbers in region A.

Place the rest of the underlined numbers in region B.



You should also be able to add new elements to a Venn diagram.

Example 6

Add the elements {13, 18, 24} to the Venn diagram from Example 4.

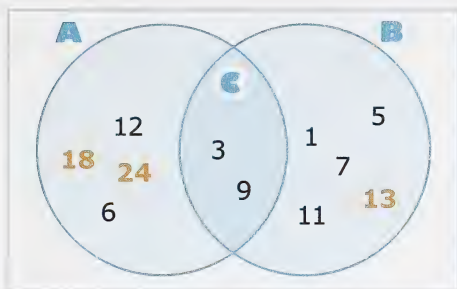
1. Underline the odd numbers:

13, 18, 24

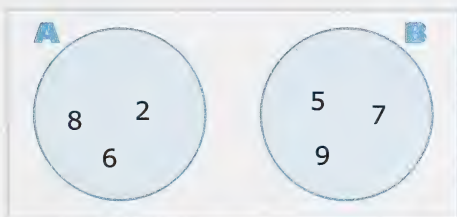
2. Circle numbers that are divisible by 3:

13, 18, 24

3. Add underlined numbers to region B and circled numbers to region A.



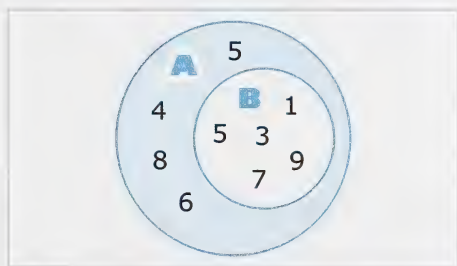
Venn diagrams come in other forms:



A = Even numbers

B = Odd numbers

These sets have no intersection so the regions are separate.



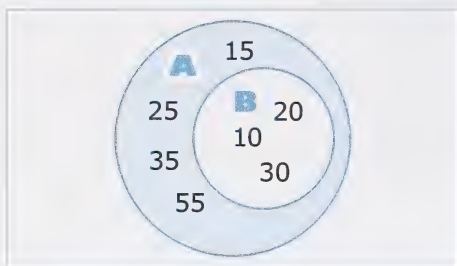
A = Numbers less than 10

B = Odd numbers less than 10

Set A contains all elements of set B by definition so region B is inside of region A.

Example 7

Describe the rules for regions A and B.



Notice that the numbers in region B are divisible by 10. The numbers in region A are not. Numbers in A are divisible by 5 and so are those in B.

The answer is: A = numbers divisible by 5
B = numbers divisible by 10

Example 8

Create a Venn diagram for the set {2, 3, 5, 9, 10, 15, 17, 21} using the rules:

A = prime numbers
and
B = odd numbers

You can use your Number Squares to move the numbers in the sets. Look at the back of this Unit in your Workbook for a Venn Diagram Mat. Cut it out and use it along with your Number Squares to help you solve this question.

1. List the odd numbers:

3, 5, 9, 15, 17, 21

2. Which of these are prime?

3, 5, 17

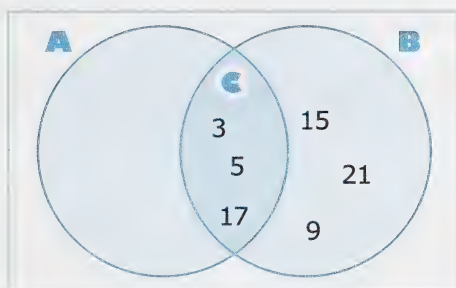
3. Which of the numbers are not odd?

2, 10

4. Are any of these prime?

2

5. Place the odd numbers in B and the odd primes in the intersection:



6. Place the 2 in A since it is prime. The 10 does not belong to either group so it goes outside of the circles, in the rectangle:



Let's Explore



Exploration 1: Creating Venn Diagram Rules

Materials: Unit 2, Lesson 4, Exploration 1 page from your Workbook, Geometry labels and shapes from the back of this Unit in your Workbook, String, Crayons, Pencil, Small piece of paper

Prepare your materials:

- Cut out the geometry labels and the shapes from your Workbook.
- Colour in the different shapes with your crayons. There are three shapes in each size. Colour one shape yellow, one red and one green for each of the different sizes.
- Cut out two long pieces of string.
- Make a chart on your piece of paper for keeping score.

Work with a partner or in groups of four. One group will be Group A. The other group will be Group B.

1. Make a Venn diagram by taking two long pieces of string and creating two circles for sets A and B.
2. Group A: Create rules for A and B. Display shapes on the Venn diagram that meet your rules. Don't tell Group B your rules.
3. Group B: Figure out the rules for A and B. Label the regions with your geometry labels.
4. Group A: Reveal the rules.
5. If Group B is correct, give them 1 point.
6. Continue taking turns in this manner until you have each had 5 turns.

The best score out of 5 wins.



Solving Problems with Logic

Venn diagrams may also be used to solve problems with **logic**. Logic is a way of looking at relationships among elements of sets.

Example 9

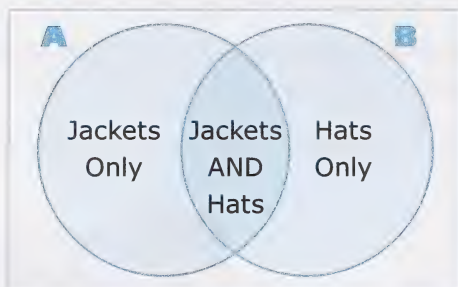
Thirty students are in line to enter the classroom. 15 of them are wearing jackets. 11 have hats on. 8 of them have both jackets and hats on. How many are wearing only jackets? How many students have neither a jacket nor a hat?



1. Draw a Venn diagram with two parts:

A = students with jackets

B = students with hats



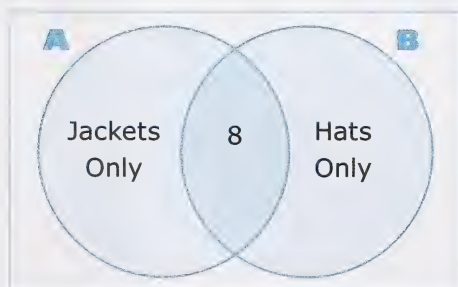
2. Organize your information:

Jackets: 15

Hats: 11

Jackets and Hats: 8

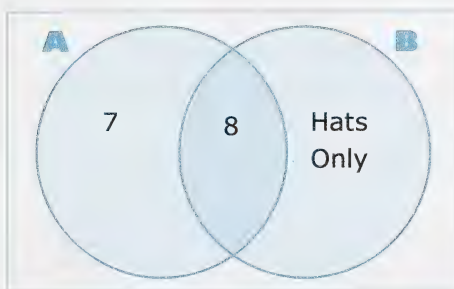
3. Place the number of students that have BOTH jackets and hats in the intersection.



4. Find the number of students who are only wearing jackets:

Number of Students with Jackets	—	Number of Students with Jackets AND Hats	=	Number of Students with Jackets ONLY
15	—	8	=	7

This goes in the part of region A that is jackets only.

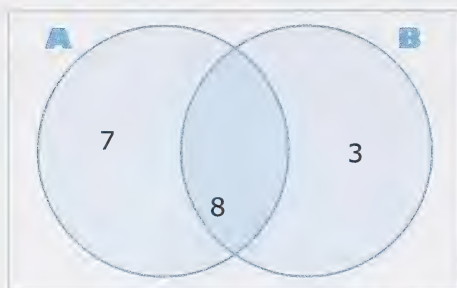


Now region A is $8 + 7 = 15$.

5. Find the number of students with only hats on:

Number of Students with Hats	—	Number of Students with Jackets AND Hats	=	Number of Students with Hats ONLY
11	—	8	=	3

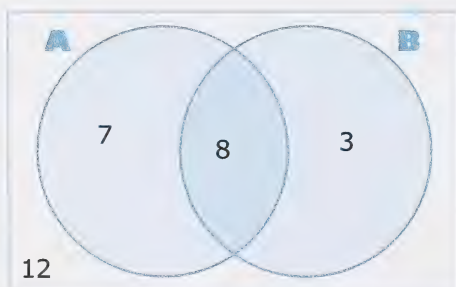
This goes in the hats only region:



6. How many students have neither hats nor jackets?
So far, in the regions you have $7 + 8 + 3 = 18$ students.
There are 30 students in total.
Find the number of students missing:

Total Number of Students	—	Number of Students with Jackets AND Hats	=	Number of Students with Neither
30	—	18	=	12

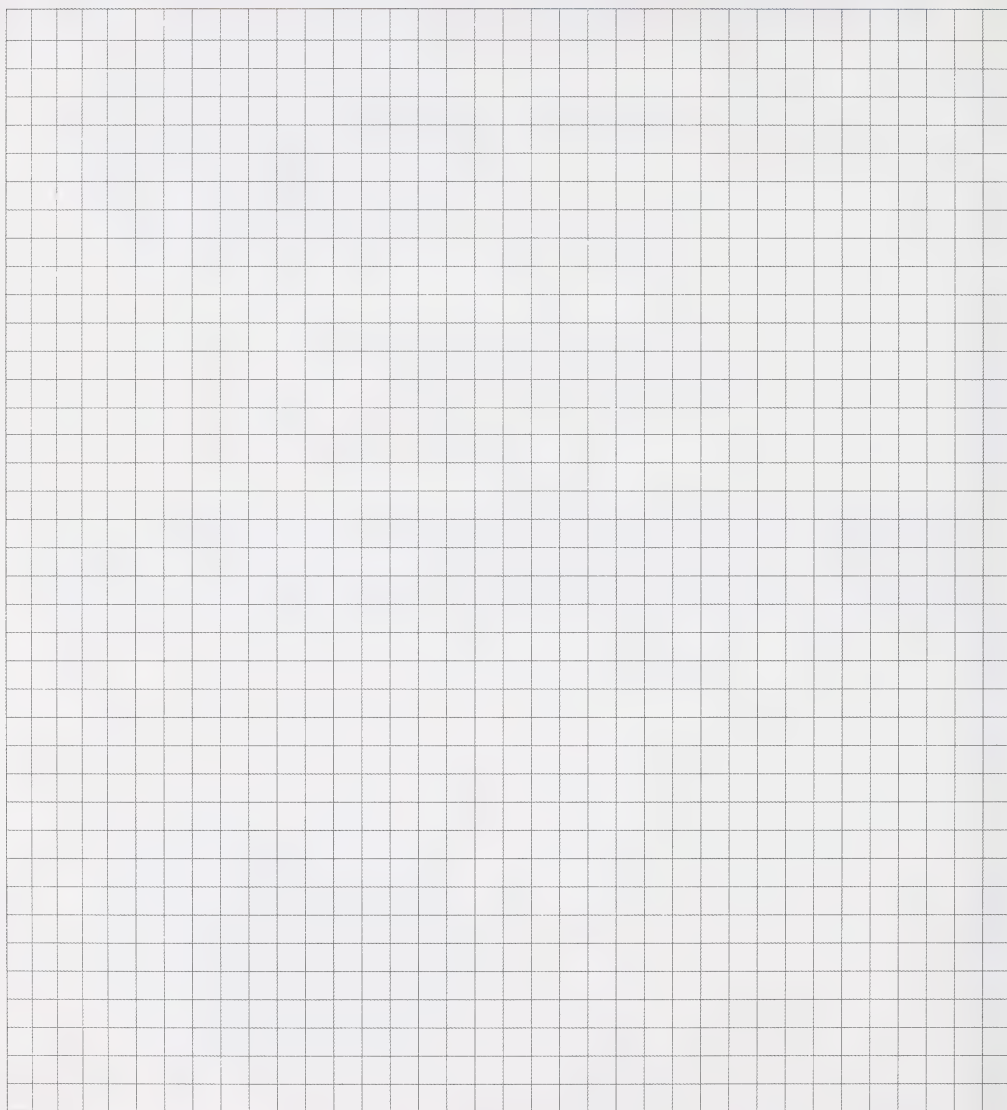
This number goes outside of the circles in the rectangle:



7 students are wearing jackets only.
12 students have neither a jacket nor a hat.



- In your Workbook go to Unit 2, Lesson 4 and complete 6 to 14.



Lesson 5

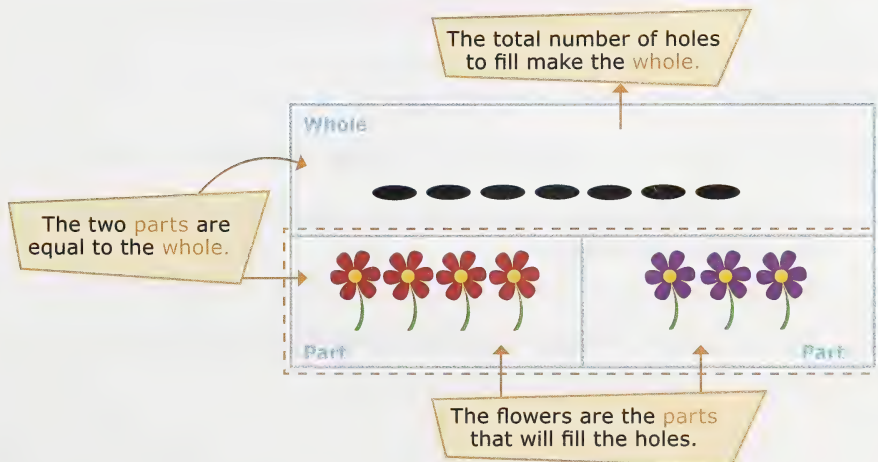
Addition and Subtraction Equations

Flower Gardening

Lian has seven holes in her garden that she wants to fill with flowers. She finds 4 red flowers and 3 purple flowers at the garden store.



Maybe you remember part-whole models? If we put the plant problem in a part-whole model it will look like this:



This problem becomes addition using the model to get:

part + part = whole

**number
of red
plants** + **number
of purple
plants** = **number
of
holes**

$$4 + 3 = 7$$

Lian has a flower to match each hole. You can use the part-whole concept to build your understanding of solving **equations**.

Reflection

How can part-whole models help you understand equations?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Solve one-step equations involving a symbol to represent an unknown number
- Solve a given one-step equation using manipulatives
- Solve a given one-step equation using guess-and-test
- Write an equation for a sentence

Go online to complete the Concept Capsule: Problem Solving Using Concrete Models (Adding and Subtracting).

Symbols

First, let's define a symbol. A **symbol** is any letter or picture used to represent a value or number. You can use symbols like these to represent objects:



= 12



= 7



= 2



= 21

You should remember solving equations that look like this:

$$\square + 5 = 9$$

The $\square$ is the symbol in this **equation**. An equation is a mathematical sentence that contains an equal sign.

The symbol represents an **unknown value**.

To solve this equation you may have thought this:

What number plus five is equal to nine?

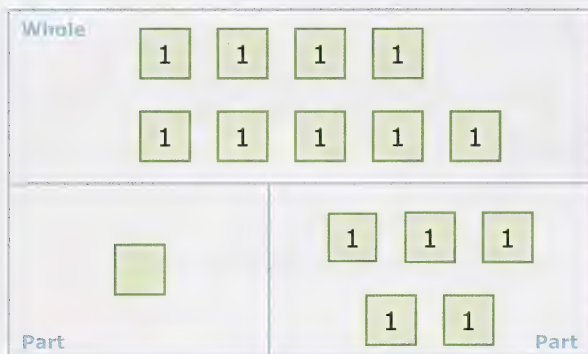
Or you may have created a part-whole model.

Let's Explore! Turn to the back of this Unit in your Workbook and find the following pages:

Algebra Tiles and Ones sheet
Part-whole Mat

Cut out the tiles and ones. Save them when you are finished with them because you will use them again later. Make the image below on the part-whole mat on your desk:

$$\square + 5 = 9$$



In this model $\square$ is the unknown and the 1s are created using algebra tiles that look like this: $\square$ 1

Modeling Addition Equations

Addition equations are in the form:

$$\text{Apple} + 6 = 10$$

$$\text{Bee} + 3 = 6$$

$$\text{Coin} + 2 = 18$$

$$\triangle + 4 = 8$$

$$\square + 7 = 12$$

$$\bigcirc + 5 = 14$$

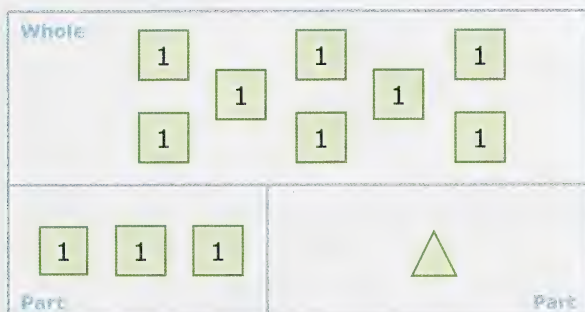
Using the part-part-whole relationship, addition equations are in the form:

part + part = whole

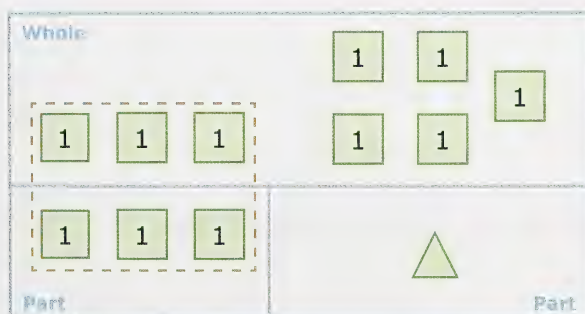
By now you are probably thinking, so how do I do this? Here is how you use a part-whole model to solve for an unknown.

Example 1

Find the value of the unknown given the model.



1. Use the Algebra Tiles and the Part-whole Mat. Create the model shown above on your desktop.
2. Match the three 1s in the part to three 1s in the whole.

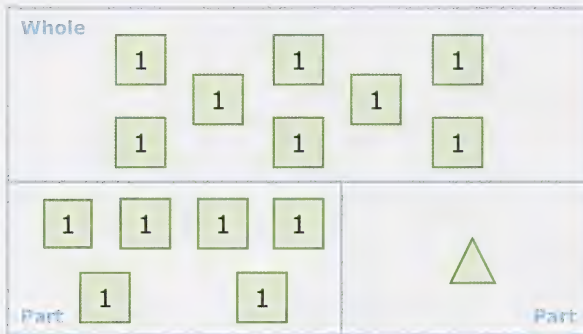


3. The unknown is equal to the 1s that are not matched to the other part. There are 5 in the whole that are not matched.

$$\triangle = 5$$

Example 2

Write an equation for the part-whole model shown.



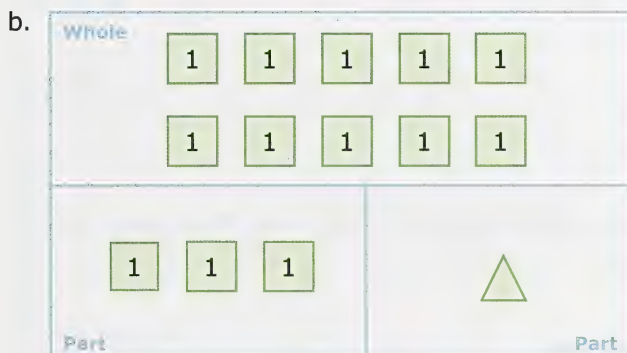
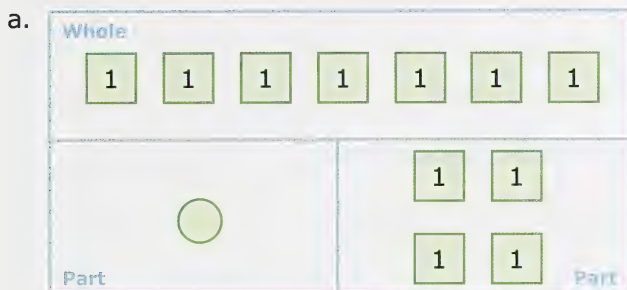
1. Use the format: Part + Part = Whole
2. Identify the parts:
Part = 6 and Part = $\triangle$
3. Identify the whole:
Whole = 8
4. The $\triangle$ goes first on the left side of the equation.
The answer is:

part + part = whole

$$\triangle + 6 = 8$$

Now It's Your Turn

Write an equation for the model and find the unknown.



Solutions

a.  + 4 = 7

 = 3

b. $\triangle + 3 = 10$

$\triangle = 7$

Modelling Subtraction Equations

Subtraction equations are in the form:

 $- 9 = 8$

 $- 7 = 4$

 $- 5 = 6$

$\triangle - 3 = 8$

$\square - 2 = 12$

$\bigcirc - 8 = 14$

You can use the part-part-whole relationship to write subtraction equations in the form:

Whole – Part = Part

The unknown is in the section representing the whole.

You could have something happen like this:

Zach is recycling plastic bottles. He has some number and puts 4 in the bin which leaves 8 bottles.



This could be solved using the equation:

$$x - 4 = 8$$

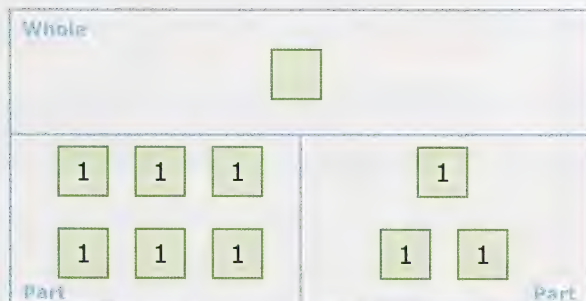
...or you could use:

$$x - 8 = 4$$

The parts can be in either the position after the minus or the position after the equal sign. The whole must be first.

Example 3

Write an equation and find the unknown in the part-whole model.



1. Make the model on your part-whole mat with algebra tiles.

Identify the parts:

Part = 6 and Part = 3

2. Identify the whole:

Whole = 

3. Use the form Whole - Part = Part:

The equation is:

Whole - Part = Part

$$\text{Whole} - 6 = 3$$

4. The whole is the sum of the parts so:

$$6 + 3 = 9$$

$$\text{Whole} = 9$$



Let's Explore



Exploration 1: Modelling Addition and Subtraction Equations

Materials: Unit 2, Lesson 5, Exploration 1 page from your Workbook, Algebra Tiles, Part-Whole Mat

Model the equations using your Algebra Tiles and Part-whole Mat. Solve.

1. $\square + 5 = 8$

$\square = \underline{\hspace{2cm}}$

2. $\square - 3 = 7$

$\square = \underline{\hspace{2cm}}$

3. $\triangle + 2 = 9$

$\triangle = \underline{\hspace{2cm}}$

4. $\triangle - 8 = 2$

$\triangle = \underline{\hspace{2cm}}$

5. $\bigcirc + 4 = 9$

$\bigcirc = \underline{\hspace{2cm}}$

6. $\bigcirc - 6 = 8$

$\bigcirc = \underline{\hspace{2cm}}$

7. Reflect: What do you do to solve an addition equation?

8. Reflect: What do you do to solve a subtraction equation?



- In your Workbook go to Unit 2, Lesson 5 and complete 1 to 6.

Solve Equations Using Guess-and-Test

We can also solve equations mentally by guessing the answer and then testing it.

Example 4

Solve using guess-and-test: $\square + 4 = 8$

Think: What number can I add to 4 to get a total of 8?

You need to replace the symbol with your guess. Next, you test by adding. If the answer is the right side of the equation, then you are done!

You may not get it right away. Write down the numbers you try.

$$2 + 4 = 6 \text{ x}$$

$$3 + 4 = 7 \text{ x}$$

$$4 + 4 = 8 \checkmark$$

$$\square + 4 = 8$$

$$\square = 4$$

Example 5

Solve using guess-and-test: $\square - 5 = 9$

Think: What number can I take 5 away from to get 9?

Record each guess:

$$15 - 5 = 10 \text{ x}$$

$$14 - 5 = 9 \checkmark$$

The answer is: $\square = 14$

Now It's Your Turn

Solve using guess-and-test.

a. + 7 = 21

b. + 12 = 36

c. - 66 = 11

Solutions

a. = 14

b. = 24

c. = 77



- In your Workbook go to Unit 2, Lesson 5 and complete 7 to 22.

Writing an Equation for a Sentence

To describe an equation we must first review the meanings of some terms and symbols.

Unknown	Addition	Subtraction	Equal sign
a number	plus	minus	is
some number	sum of	difference of	equals
what number	increase by	decreased by	yields

When you see these clue words you will replace them with the symbol they represent.

Example 6

Write an equation for the sentence:

The difference of a number and 4 is 24.

1. Identify the operation:

The phrase "difference of" means subtraction. You will subtract the **two parts that follow this phrase** in order. The two parts are "a number" and "4".

2. Identify the unknown:

The phrase "a number" means the unknown. Choose a symbol:

3. Write the left side of the equation using the information you just identified: - 4

4. Identify the rest of the equation:

"Is" will become the equal symbol and 24 is after the equal.

5. Write the equation.

$$\square - 4 = 24$$

Now It's Your Turn

Write an equation for each sentence.

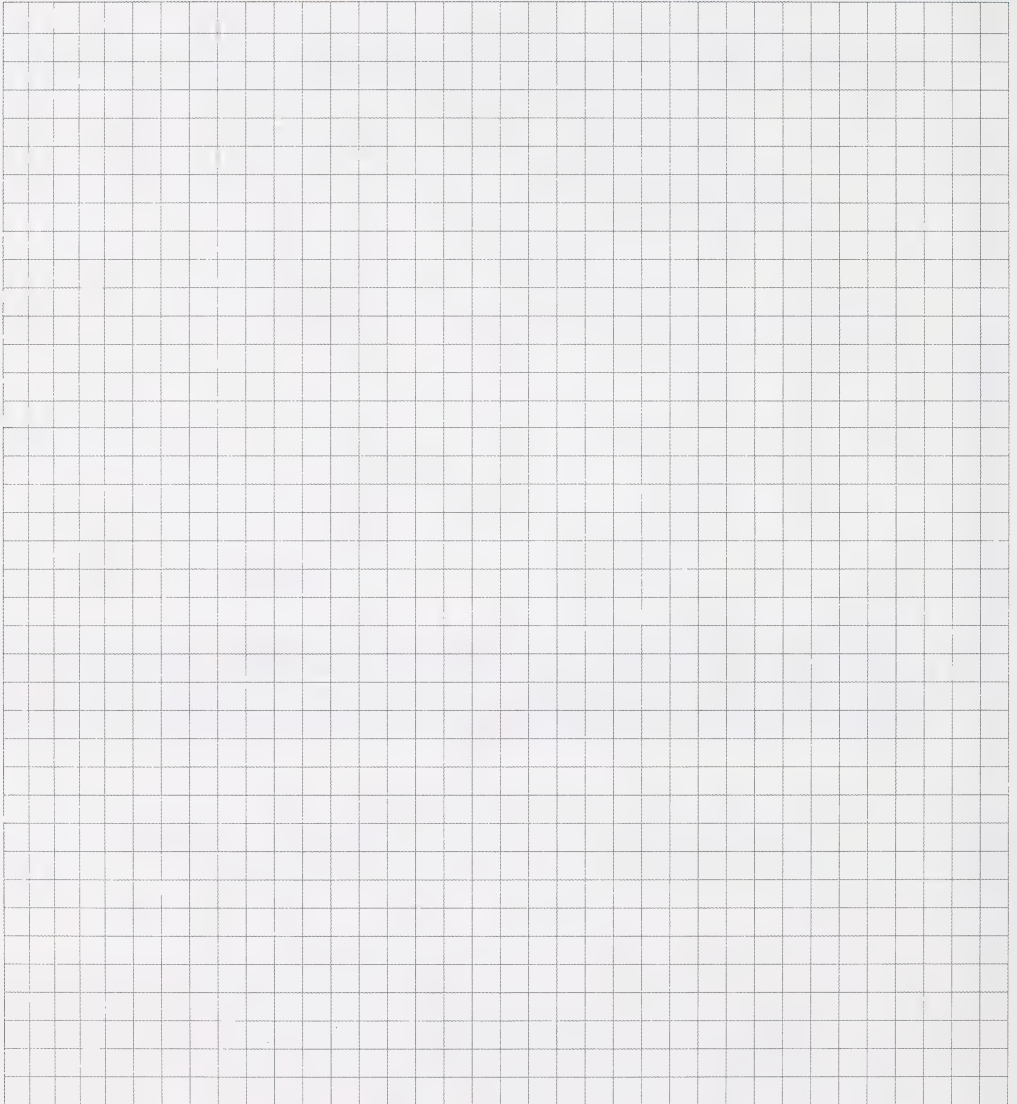
- The sum of a number and eleven is twenty.
- A number minus five equals ten.
- Some number plus 25 equals 48.

Solutions

- $\square + 11 = 20$
- $\square - 5 = 10$
- $\square + 25 = 48$



- In your Workbook go to Unit 2, Lesson 5 and complete 23 to 29.



Lesson 6

Multiplication and Division Equations

Marbles

People have been playing marbles and marble-like games for thousands of years. It is thought that marbles started with the cave people playing with small pebbles or balls of natural clay. Clay balls have been found in the tombs of Egypt. They have also been found in Native American burial grounds. They have also been discovered in the ancient Aztec pyramids.

Zach has 12 marbles that he wants to share with his friends Cameron and Daksha. To share them among all three boys he will divide them up as shown:



Zach's reasoning can be used to solve multiplication and division equations.

Reflection

How can you use Zach's method for multiplication?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Solve multiplication and division equations
- Solve equations using manipulatives
- Solve equations using guess-and-test
- Write equations for a sentence

Go online to complete the Concept Capsule: Problem Solving Using Concrete Models (Multiplying and Dividing).

Modeling Multiplication Equations

Multiplication equations look like these:



$$\times 2 = 28$$



$$\times 8 = 16$$



$$\times 6 = 30$$

 $\times 5 = 15$

 $\times 4 = 24$

 $\times 7 = 35$

You can use a model of the multiplication sentence to solve these equations.

Let's Explore! Turn to the back of this Unit in your Workbook and find the following page: Two-part Mat

Other materials: Any type of counters (beans, small candies...), Small cups, Pencil, Algebra Tiles (from Lesson 5)

Use these materials to model each equation in the examples of the lesson.

Example 1

Solve  $\times 5 = 15$ using a model.

1. Gather the number of counters or 1s tiles for the number you see on the right side of the equation. In this case you need 15 counters or tiles.



2. Group the 15 counters into equal groupings of 5 since that is the **multiplier**.



3. How many groupings did you make? That is the answer.

= 3

Another way you can model this is using cups and counters. Counters can be anything you have handy like dry beans or colour chips. Find some counters to help you model the next problem.

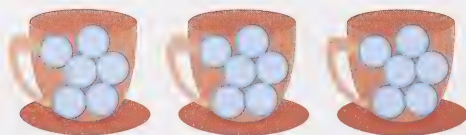
Example 2

Create a model and solve $\bigcirc \times 3 = 18$

1. Take 3 cups to represent the multiplier.



2. Use the 18 counters. Put one counter in each cup. Repeat until you have used all 18 counters.



3. The answer is the number of counters in each cup.

$$\bigcirc = 6$$

Modelling Division Equations

Division equations may look like these:

$$\text{frog} \div 3 = 2$$

$$\text{bee} \div 9 = 4$$

$$\text{apple} \div 6 = 10$$

$$\square \div 5 = 15$$

$$\triangle \div 4 = 10$$

$$\bigcirc \div 7 = 8$$

You can use counters to model division equations.

Example 3

Model the equation $\triangle \div 4 = 10$ and find the unknown.

1. Think: **Some number** divided by 4 is 10. Is the number larger than 10 or less than 10? If you are thinking larger, you are right.
2. You are looking for a number that can be divided into 4 groups with 10 in each group.



3. Now how many counters do you have in all? That is your answer:

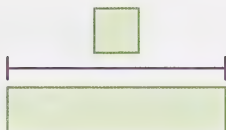
$$\triangle = 40$$

Another model for division is partitioning a shape like a rectangle.

Example 4

Solve $\square \div 5 = 3$ using a model.

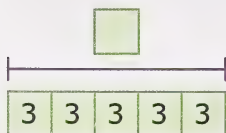
1. Draw a rectangle that represents the unknown.



2. Partition the rectangle into 5 pieces.



3. Each of the 5 pieces has a value of 3, which is the right side of the equation:



4. The answer is found by adding the 3s in the figure, since that is equal to the total.

$$\square = 15$$



- In your Workbook go to Unit 2, Lesson 6 and complete 1 to 4.

Solve Equations Using Guess-and-Test

You can also solve equations mentally by guessing the answer and then testing it.

In Zach's problem of sharing his marbles you can guess the number of marbles each boy will get. You can take the marbles and pass them out to see if they each have the same number.

If you guessed that they will get 4 marbles each, you are right. Guess a number for the unknown and test it by using it in the equation.



Example 5

Solve using guess-and-test: $\square \times 4 = 8$

Think: What number times 4 equals 8?

You should notice that 8 is twice as much as 4, so you can try 2.

$$2 \times 4 = 8 \checkmark$$

The answer is: $\square = 2$

You may not always get it on the first guess. You will get better at it the more you practice.

Example 6

Solve using guess-and-test: $\square \div 8 = 5$

Think: What number divided by 8 equals 5? Should the number be larger or smaller than the answer 5? If you are thinking larger, you are right.

Guess-and-Test: Only try numbers that 8 will divide into evenly.

$$56 \div 8 = 7 \times$$

$$48 \div 8 = 6 \times$$

$$40 \div 8 = 5 \checkmark$$

$$\square = 40$$

Now It's Your Turn

Solve by guessing and testing.

a. $\square \times 7 = 42$

b. $\square \times 9 = 36$

c. $\square \div 6 = 11$

Solutions

a. $\square = 6$

b. $\square = 4$

c. $\square = 66$

Here is an Exploration to help you see how you can use a multiplication table to solve an equation.



Exploration 1: Multiplication Table and Equations

Materials: Unit 2, Lesson 6, Exploration 1 page from your Workbook, Multiplication Table from the back of this Unit in your Workbook, Crayons or counters, Paper, Pencil

1. Use the Multiplication Table. For the equation $\square \div 8 = 5$, follow the 8 row across and the 5 column down at the same time. The number in the intersection is the answer.
2. For the equation $\square \times 7 = 42$, follow the 7 row across until you get to 42. Now follow that column up and identify the number at the top. This is the unknown.

3. Try these using the multiplication table:

$\square \div 4 = 3$

$\square \div 2 = 9$

$\square \div 7 = 4$

$\square \times 4 = 12$

$\square \times 9 = 18$

$\square \times 4 = 28$

Reflection

How does a multiplication equation relate to a division equation? Use an example to explain your answer.

Let's Practice

- In your Workbook go to Unit 2, Lesson 6 and complete 5 to 20.

Write Equations for a Sentence

To describe an equation we must first review the meanings of a few terms and symbols.

Unknown	Multiplication	Division	Equal sign
a number	product of	quotient of	is
some number	times	divided by	equals
what number	twice		yields

Use these clue words to write an equation for a sentence.

Example 7

Write an equation for the sentence:

The product of a number and 4 is twelve.

1. Identify the operation:

"The product of" tells you this is multiplication. You will multiply the two things that follow this phrase: "a number and 4."

2. Identify the unknown and write the left side of the equation:

If the unknown is the left side is x 4

3. Write the equation:

"is twelve" becomes = 12. Put this together with the left side:

$$\text{} \times 4 = 12$$

Now It's Your Turn

Write the equation for the sentences:

- a. The product of a number and 2 is 50.
- b. A number divided by 3 equals 5.
- c. Some number multiplied by fourteen is twenty-eight.

Solutions:

- a. $\square \times 2 = 50$
- b. $\square \div 3 = 5$
- c. $\square \times 14 = 28$



- In your Workbook go to Unit 2, Lesson 6 and complete 21 to 27.

Lesson 7

Problem Solving with Equations

Distance Travelled

Imagine that you are going on vacation with your family. You look out of the car window to see how far it is to Banff National Park. The sign says:

Calgary		$+ 80 = 120 \text{ km}$
Banff		$- 20 = 70 \text{ km}$

Problems are not usually presented like this. You are more likely to see the distance to Calgary on the sign like this:

Calgary	40 km
---------	-------

You still don't know how far it is to Banff from where you are at on your route. You can take out the map and find that it is 130 km from Calgary to Banff. Now you can write an equation to find the distance.



Reflection

What types of equations can you solve?

Objectives for this Lesson

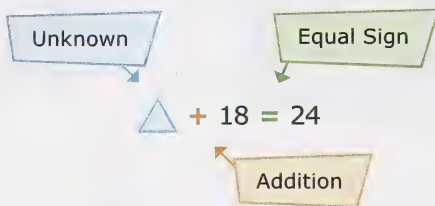
In this lesson you will explore the following concepts:

- Express a given problem as an equation and solve
- Create a problem in context for a given equation

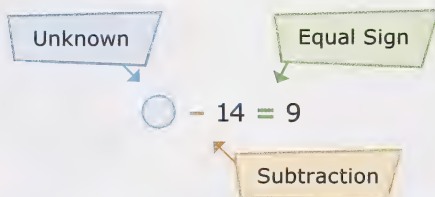
Solving Addition and Subtraction Word Problems

Solving a word problem is like writing an equation from a sentence.

Think about the parts of an addition equation:



Subtraction equations have the parts shown here:



You can use the part-part-whole relationship to help you decide if word problems are addition or subtraction equations.

Part + Part = Whole

Whole - Part = Part

If a part is missing, it is an addition equation. If the whole is missing, it is a subtraction equation.

Example 1

Create a part-whole model for the problem and solve.

Daksha has 20 baseball cards in his collection. Zach has 15 more cards than Daksha. How many cards does Zach have?

- Create the part-whole model.
- Write an equation for the model.
- Find the unknown.

1. First, identify the unknown:

You need to know the number of cards Zach has.

2. What do you know?

Daksha has 20 cards

Zach has 15 more cards than Daksha

Unknown: Zach's cards

3. Identify the regions of the part-whole model:

Part 1: Daksha's cards 20

Part 2: 15

Whole: Zach's cards



4. Create the part-whole model:



5. Write the equation for the model. The unknown is in the whole, so this is a subtraction equation.

$$\square - 15 = 20$$

6. Solve the equation:

$$\square = 35$$

7. Write the answer as a sentence:

Zach has 35 cards in his collection.

Example 2

Create a part-whole model for the problem and solve.

Alyssa is saving money for a summer camping trip. She has \$120. She needs \$250 to go on the trip. How much more money does Alyssa need?

- Create the part-whole model.
- Write an equation for the model.
- Find the unknown.



1. Identify the unknown:

You need to know the amount of money Alyssa needs.

2. What do you know?

Alyssa has **\$120** – this is a part

Alyssa's trip costs **\$250** – this is the whole

Alyssa needs more money – this is a missing part and the unknown

3. Organize information in the model:



4. Write an equation for the model. A part is missing, so the equation is an addition equation.

$$\square + 120 = 250$$

5. Solve the equation.

$$\square = 130$$

6. Write the answer as a sentence.

Alyssa needs \$130 more to go on her trip.

So remember, to solve these word problems, use your part whole model and decide if the equation is addition or subtraction. The unknown tells you the type of equation.



- In your Workbook go to Unit 2, Lesson 7 and complete 1 to 6.

Solving Multiplication and Division Word Problems

Word problems that may be written as multiplication and division equations will have a form for each equation that looks like this:

$\triangle \times \text{value} = \text{value}$

or

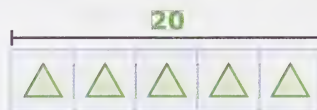
$\square \times \text{value} = \text{value}$

You can also create a model of the problem. This will help you decide if you need to write a multiplication equation or division equation.

You should recall from Lesson 6 that a multiplication or division equation may have models like these:



This models: $\square \div 8 = 5$



This models: $\triangle \times 5 = 20$

You can use your model to help you decide the type of equation you must write.

Example 3

Create a model for the problem and solve.

Cameron played in 8 basketball games. He scored 4 points in each of the games he played. How many points did he score in all the games?

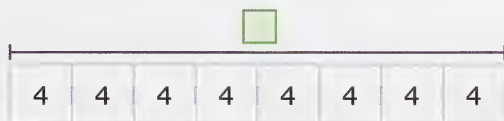


- Create a model to represent the problem.
- Write an equation for the model.
- Solve the equation.

1. First identify the unknown:

You need to know the number of points Cameron scored.

2. Represent the problem with a model:



3. The unknown represents the larger amount and it is divided into 8 sections of 4:

$$\square \div 8 = 4$$

4. Solve the equation

$$\square = 32$$

5. Write the answer as a sentence:

The answer is: Cameron scored 32 points in all.

Example 4

Create a model for the problem and solve.

Lian is making banana splits for her birthday party. She counted 10 bananas in her box. If there are going to be 5 girls at her party, how many bananas will each get on their banana split?



- Create a model to represent the problem.
- Write an equation for the model.
- Solve the equation.

1. Identify the unknown:

You need to know the number of bananas each girl will get.

2. Set up a model.

Make a model of handing out the bananas one at a time.



3. Write the equation.

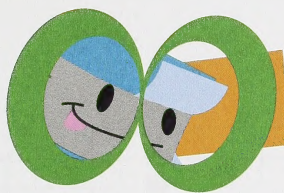
$$\square \times 5 = 10$$

4. Solve the equation.

$$\square = 2$$

5. Write the answer as a sentence.

Each girl will get 2 bananas.

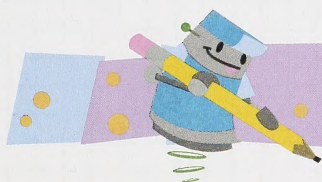


Let's Explore

Exploration 1: Writing Word Problems

Materials: Unit 2, Lesson 7, Exploration 1 page from your Workbook, Algebra Tiles, Part-whole Mat

1. Create an addition equation. Write your equation and solve it.
2. Create a story problem for your equation.
3. Create a subtraction equation. Write your equation and solve it.
4. Create a story problem for your subtraction equation.
5. Create a multiplication equation. Write your equation and solve it.
6. Create a story problem for your multiplication equation.
7. Create a division equation. Write your equation and solve it.
8. Create a story problem for your division equation.



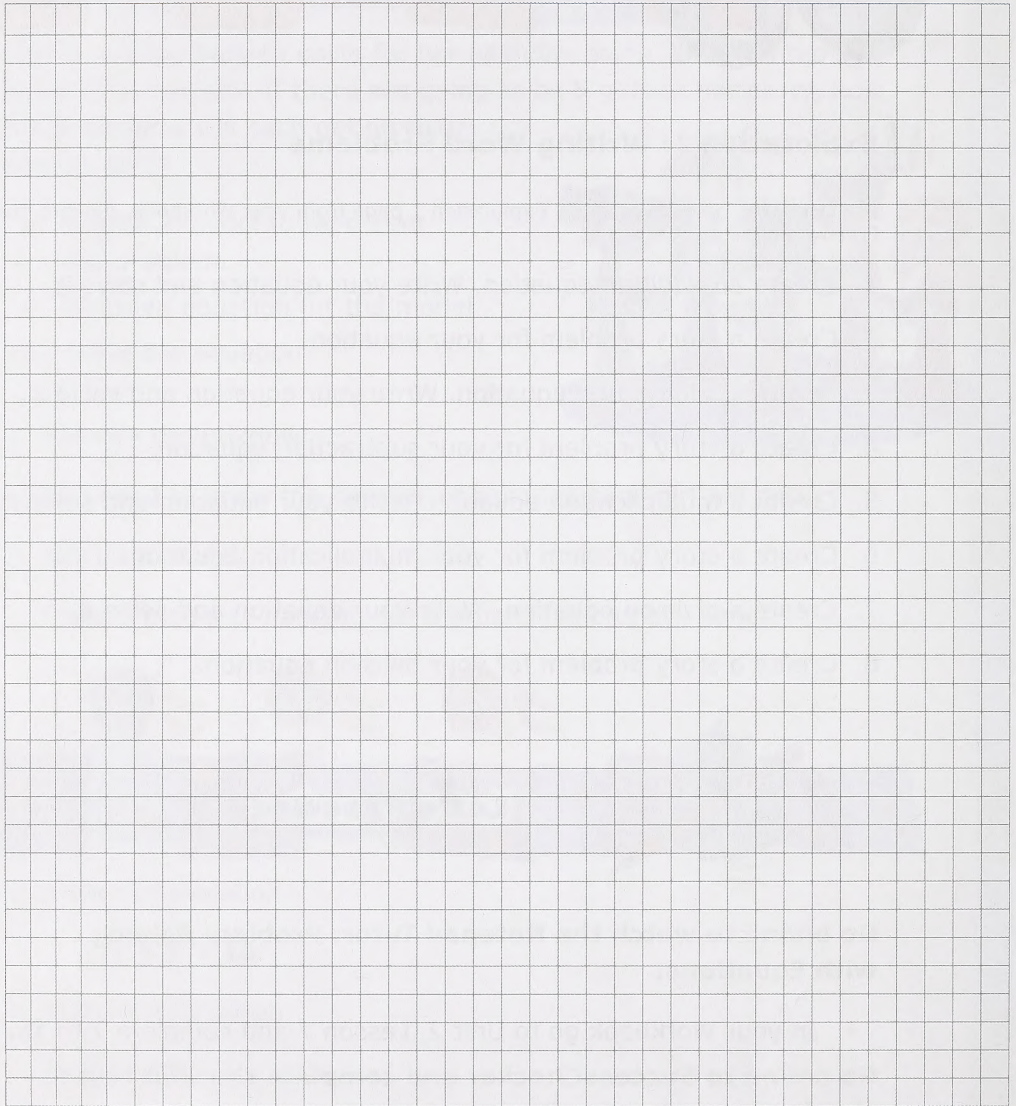
Let's Practice

Go online to watch the Notepad Tutor: Problem Solving with Equations.

- In your Workbook go to Unit 2, Lesson 7 and complete 7 to 15.

Go online to SuccessChecker and complete the Unit test to check your understanding.

Go online to play games that will help you review you glossary terms.



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